The Cybersecurity Mindset

Cybersecurity

Cybersecurity 101 Day 1

CompTIA Partnership

As part of the course, all students will receive:

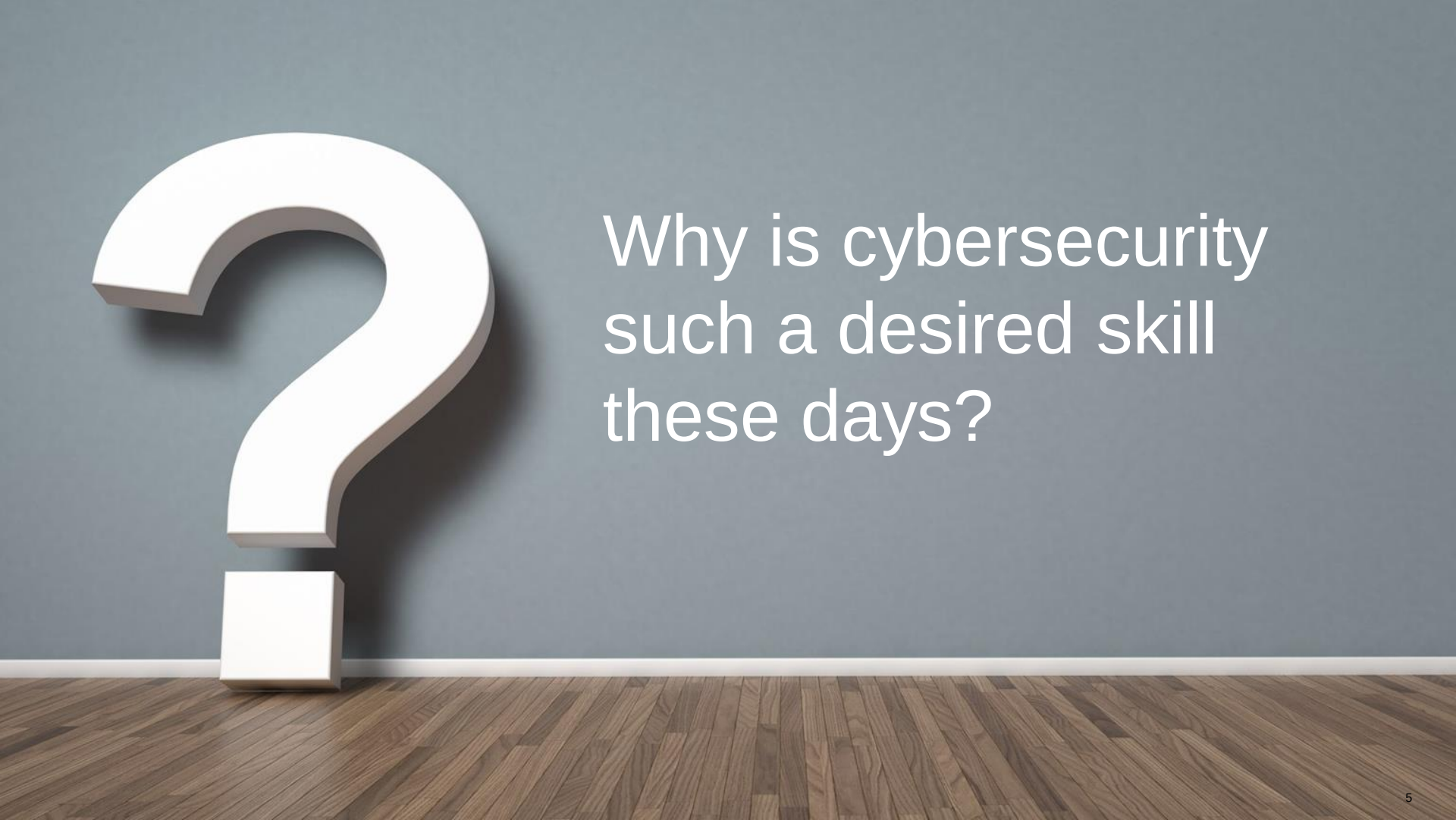
- Access to CompTIA CertMaster Practice for Security+
  - An adaptive knowledge assessment and certification training companion tool that will help you gain knowledge and prepare for the Security+ CompTIA exam.
  - Features question-first design, real-time learning analytics, and content refreshers to help reinforce and test what you know and close knowledge gaps.
  - You will receive access partway through the course.
- CompTIA Security+ exam voucher
  - Exam vouchers are valid for 12 months.
  - You will receive it at the end of course, in order to give the voucher the longest shelf-life possible and give you time to study.

Class Objectives

By the end of today's class, you will be able to:

- Explain the course structure and general direction of the program.
- Recognize the high-level security strategies and tools covered in class.
- Explain how cybersecurity is an assessment of threats and mitigation of risks.
- List different types of user, web, server, and database cybersecurity attacks.
- Identify risk mitigation plan framework for user, web server, and database attacks.

The Rising Cyber Threat


Why is cybersecurity such a desired skill these days?

Reason 1: Explosive Growth in Dependence of IT

Nearly every personal, social, and commercial aspect of our lives makes contact with **vulnerable IT infrastructure**.

Reason 2:
More Users (Targets) on Connected Devices

More people than ever before are logged into connected devices—often for the majority of their waking (and sleeping) hours.

Reason 3:
Better Tools for Bigger Damage

Today's cyber attacks are becoming more sophisticated, aggressive and disruptive than ever before.

The Switch

Equifax's massive 2017 data breach keeps getting worse

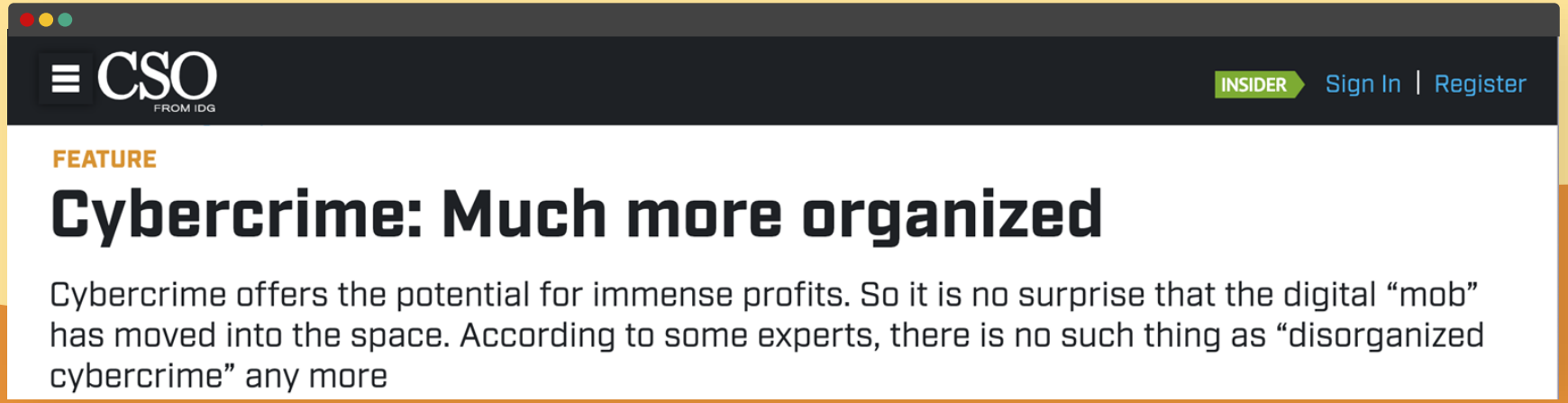
(Michael Nagle/Bloomberg News)

By **Brian Fung**
March 1, 2018

Equifax said Thursday that 2.4 million more consumers than previously reported were affected by the massive data breach the company suffered last year, adding to an already stunning toll.

Reason 4:
Significant Investment by Bad Actors

The field was once populated by individual “lone hackers.” It has become a focal point for organized crime, nation states, and private enterprises.



Reason 5: Dire Shortage of Skilled Professionals

According to studies by $(ISC)^2$, there will be over 1.5 million unfilled cybersecurity positions by 2020.

"70% of cyber security professionals say that their organization has been impacted by the ongoing global cybersecurity skills shortage."

Defining Cybersecurity

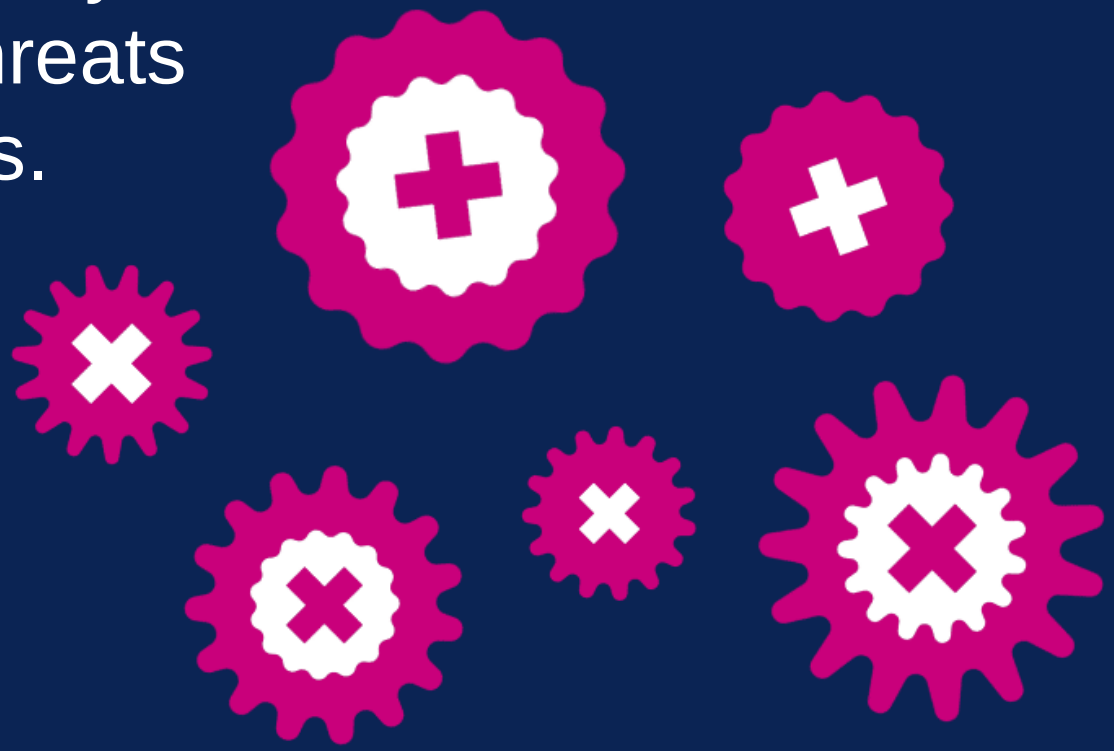

What is the first thing you think of when you hear cybersecurity?

Everyone’s First Thoughts:

Hackers and **complicated code**...

But cybersecurity isn't about complicated code and hackers...

Cybersecurity is really about assessing threats and mitigating risks.



Assessing Threats: A Wild USB Appears!

Let’s say we found a USB drive laying on the ground. **How much of a threat could that *really* be?**

Or…

What if it’s a fanciful USB that appears!?

What harm could it do?

What harm could it do?

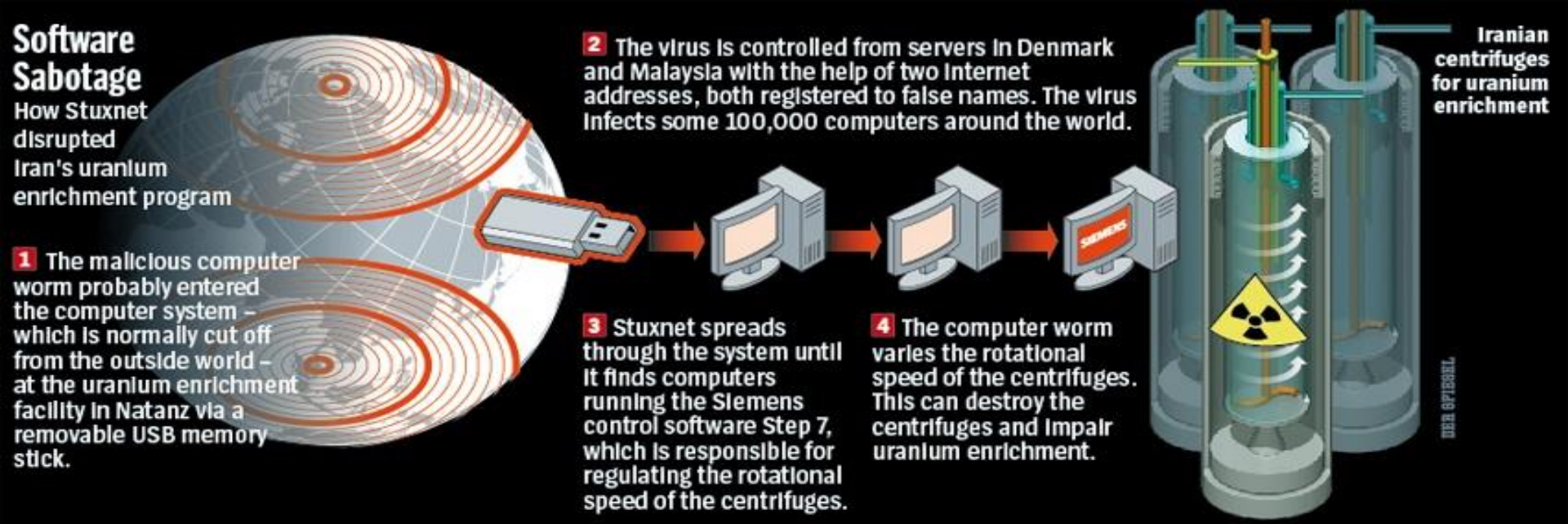

LOCATION: SOMEWHERE OVER THE RAINBOW


BEFORE PLUGGING IN USB


AFTER PLUGGING IN USB

Software Sabotage

How Stuxnet disrupted Iran's uranium enrichment program



1 The malicious computer worm probably entered the computer system – which is normally cut off from the outside world – at the uranium enrichment facility in Natanz via a removable USB memory stick.

2 The virus is controlled from servers in Denmark and Malaysia with the help of two Internet addresses, both registered to false names. The virus infects some 100,000 computers around the world.

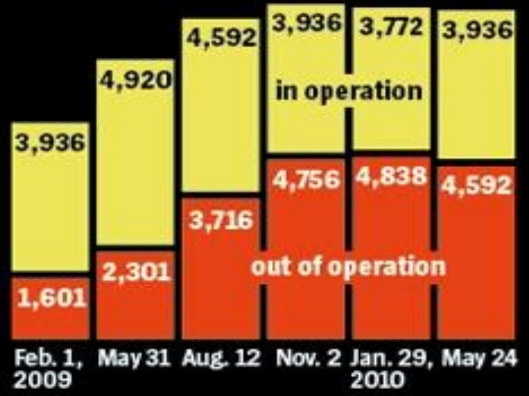
3 Stuxnet spreads through the system until it finds computers running the Siemens control software Step 7, which is responsible for regulating the rotational speed of the centrifuges.

4 The computer worm varies the rotational speed of the centrifuges. This can destroy the centrifuges and impair uranium enrichment.

Iranian centrifuges for uranium enrichment

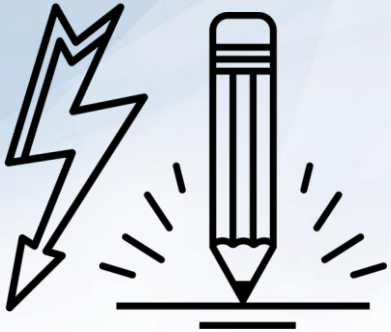
DER SPIEGEL

5 The Stuxnet attacks start in June 2009. From this point on, the number of inoperative centrifuges increases sharply.



Source: IAEA, ISIS, FAS, World Nuclear Association, FT research

1/5



Quick Activity: A Wild USB Appears!

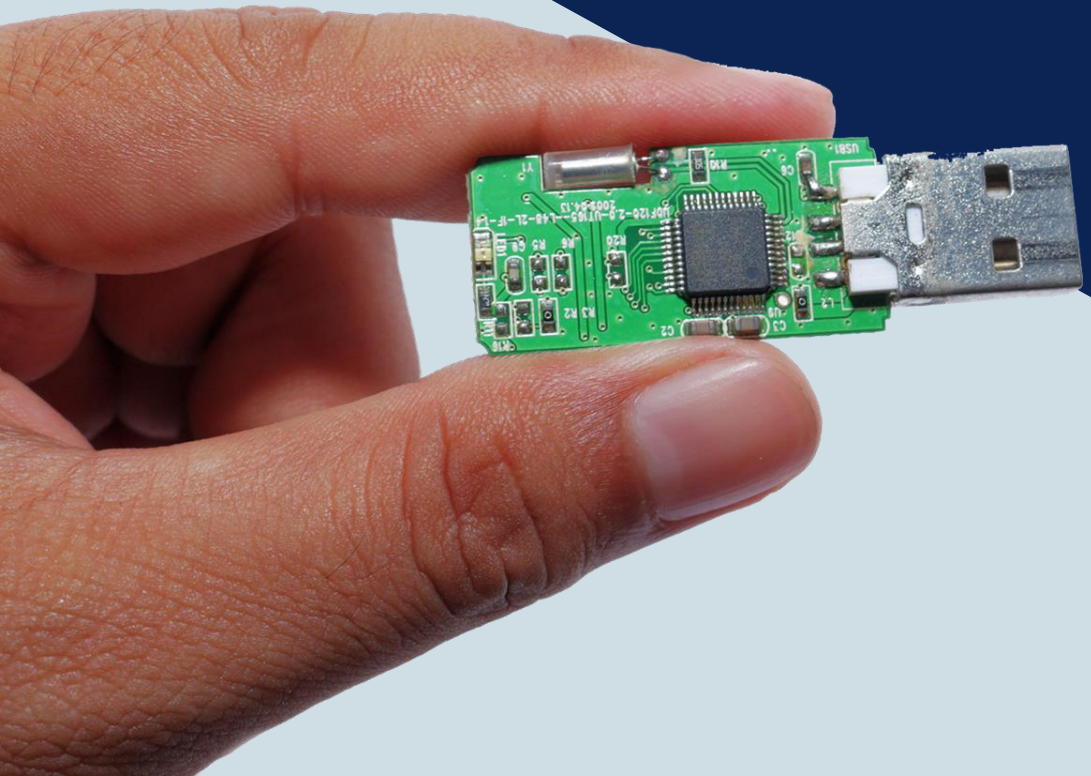
Turn to the person next to you and discuss what could happen.

1. How might it be that a USB drive is able to immediately execute running code?
2. Why can’t our computer stop the drive from running?
3. How might we defend against malevolent USBs like this?

Suggested Time: 5 Minutes

A Harmless USB?

What if the USB was a **mini keyboard emulator**? When connected, our computer registers it as a keyboard allowing it to kick off without restriction. Like most threats, their appearances are deceptive and seemingly safe.



Know the Threats

To the experienced cybersecurity professional, risks are everywhere.

A hacker gained access to 100 million Capital One credit card applications and accounts

By Rob McLean, CNN Business

Updated 8:46 AM ET, Tue July 30, 2019

New Hacking Technique Can Steal Info Through PC Speakers and Headphones

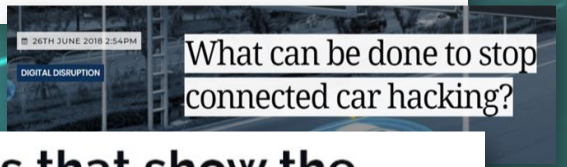
TECHNOLOGY

Email Is Dangerous

Electronic mail as we know it is drowning in spam, forged phishing mails, and other scams and hacks. It's going to get worse before it gets better.

The SIM Hijackers

Has someone hacked your webcam? Here's how to stop cyber-snoopers



Critical Bluetooth Flaws Put Over 5 Billion Devices At Risk Of Hacking

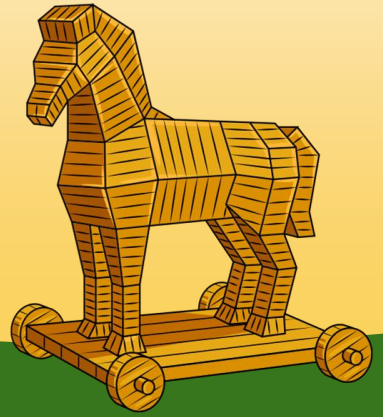
Five nightmarish attacks that show the risks of IoT security

The Internet of Things is not going away -- and neither are the attacks that exploit device vulnerabilities. Here are five incidents that illustrate what users and device developers need to do to prevent breaches.

By Jack Wallen | June 1, 2017 -- 16:31 GMT (09:31 PDT) | Topic: Cybersecurity in an IoT and Mobile World

Mitigating Risks

Historically, organizations viewed cybersecurity from the lens of the **castle model**: managing risks meant building walls and keeping the bad actors **out.**



Today, security professionals operate in a world where **breach is assumed**, and the risks associated with such events also **need to be mitigated**.

Course Overview

Our Future Tool Belt

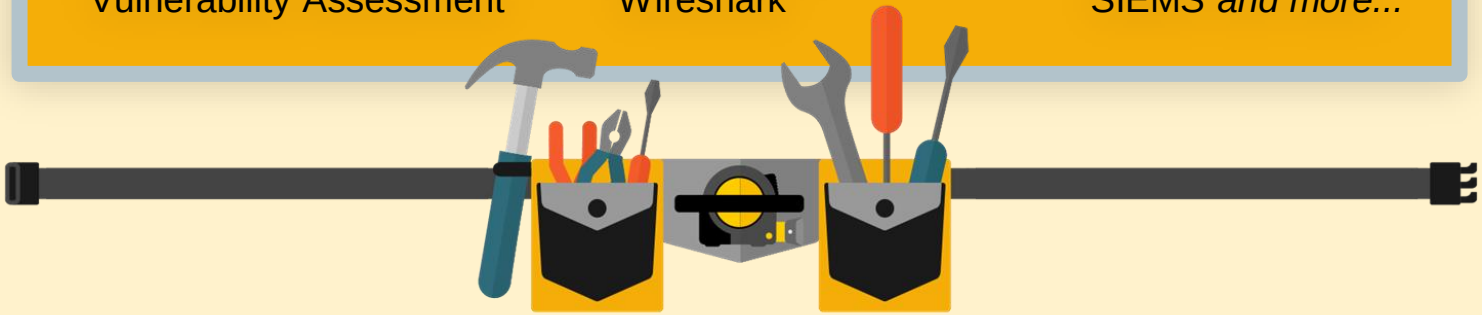
Our Goals:

Threat Assessment

Risk Mitigation

Our Tools:

Network Security	Security Policy	Kali Linux
Web Security	Risk Analysis	Nmap
OS Security	Compliance Strategy	Nessus
Cryptography	Operational Security	Metasploit
Penetration Testing	UNIX Command Line	Burp Suite
Vulnerability Assessment	Wireshark	SIEMS *and more...*



Daily Routine

In class, we'll run through the following:

- Set Objectives
- Brief Background Lecture
- Instructor Demonstrations
- Thought Exercises
- In-Class Skill Builders
- Project Work

Curriculum at a Glance

Module 1 Security Fundamentals

Learn to think like cybersecurity professionals, by assessing threats and mitigating risks. Look at security from an organizational perspective via governance, risk, and compliance. Understand how security controls impact an organization and its employees

Module 2: System Administration

Linux and Windows systems administration. Hands-on experience working with the command line and commands that are prominent in IT roles. Configure and audit servers, and harden them from malicious attacks. Programming via Bash and Powershell.

Module 3: Networks and Network Security, and Project 1

Network configuration, design, protocols and data communication. Network security, cryptography, and cloud virtualization and security.

Module 4: Offensive Security, and Project 2

Web applications, databases, and the vulnerabilities and hardening associated with them. Windows and Linux penetration testing, using tools such as Nessus, Metasploit, and Burpsuite.

Module 5: Defensive Security

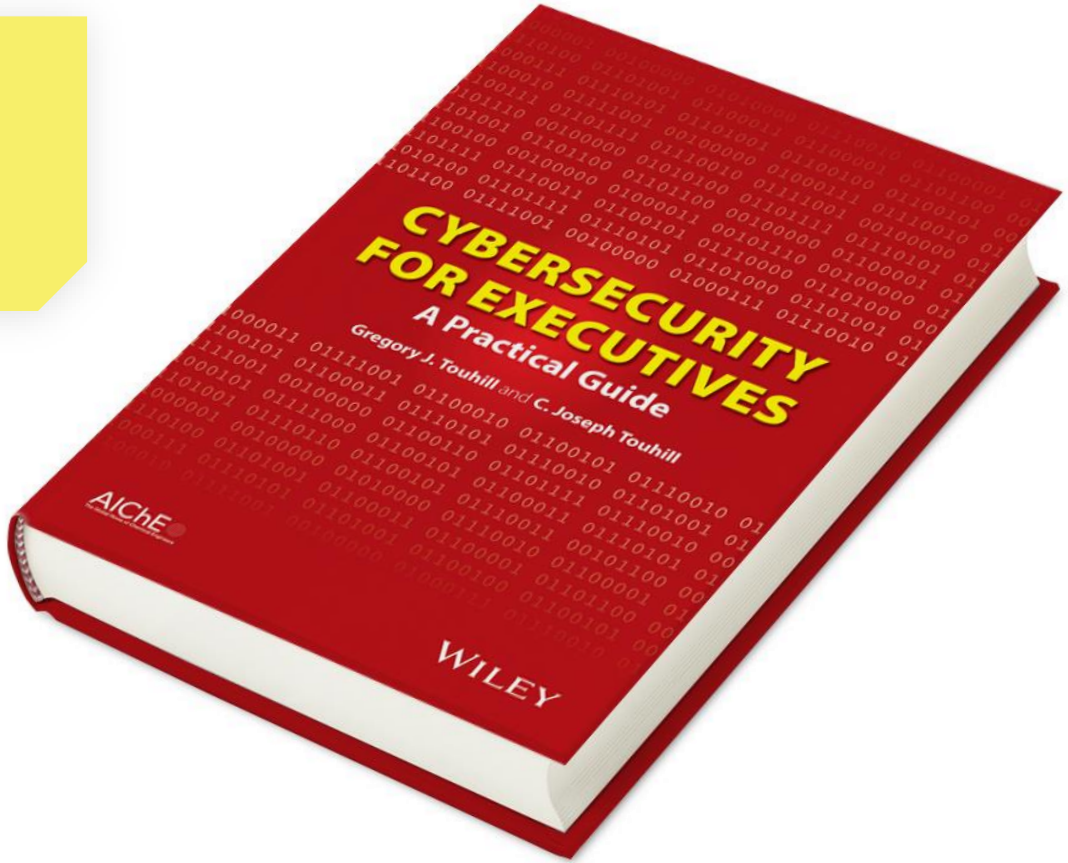
SIEMs with Splunk. Setting up security monitoring, alerts, dashboards, and custom reports. Understanding of the Incident Response framework, and responding to breaches and incidents. Using Forensic tools to recover deleted data.

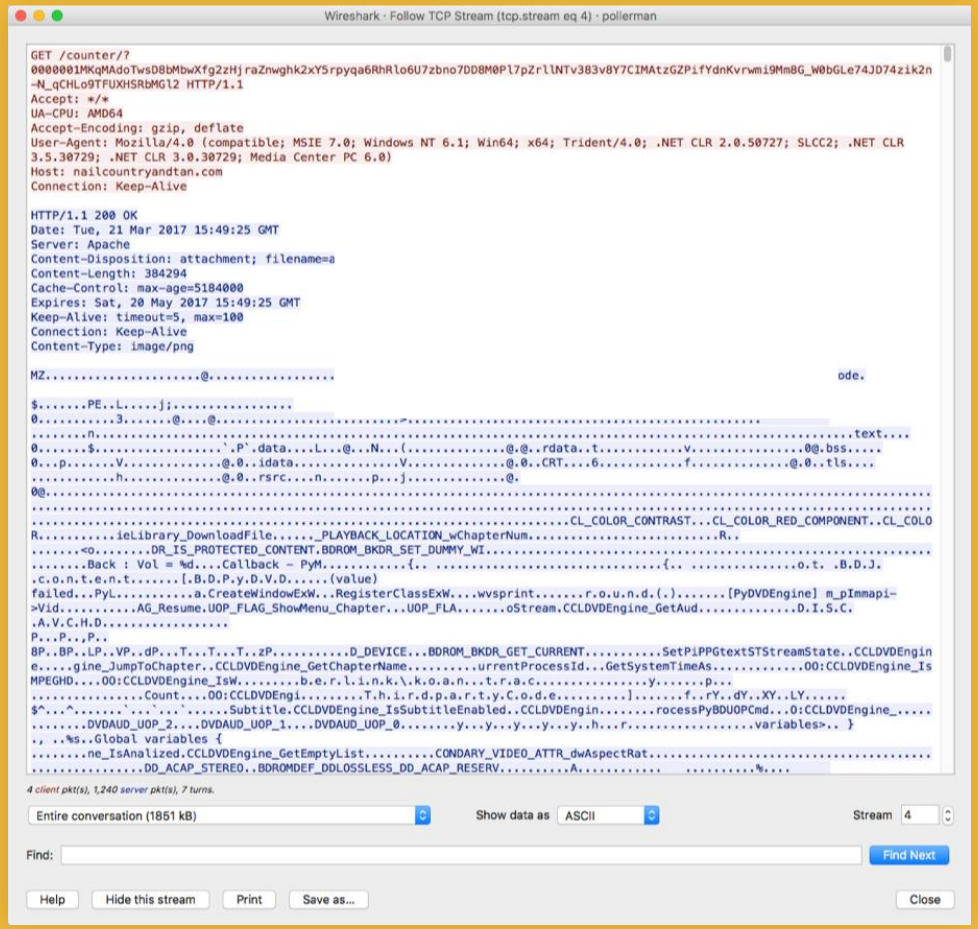
Module 6: Review and Final Projects

Certification prep and review. Interviewing and career prep practice. Final projects involving deployment of virtual networks to the cloud.

Example Activity: **Cybersecurity Policy and Strategy**

We'll learn how to *talk* about cybersecurity risks, strategy, and policy in a broad organizational and business capacity.



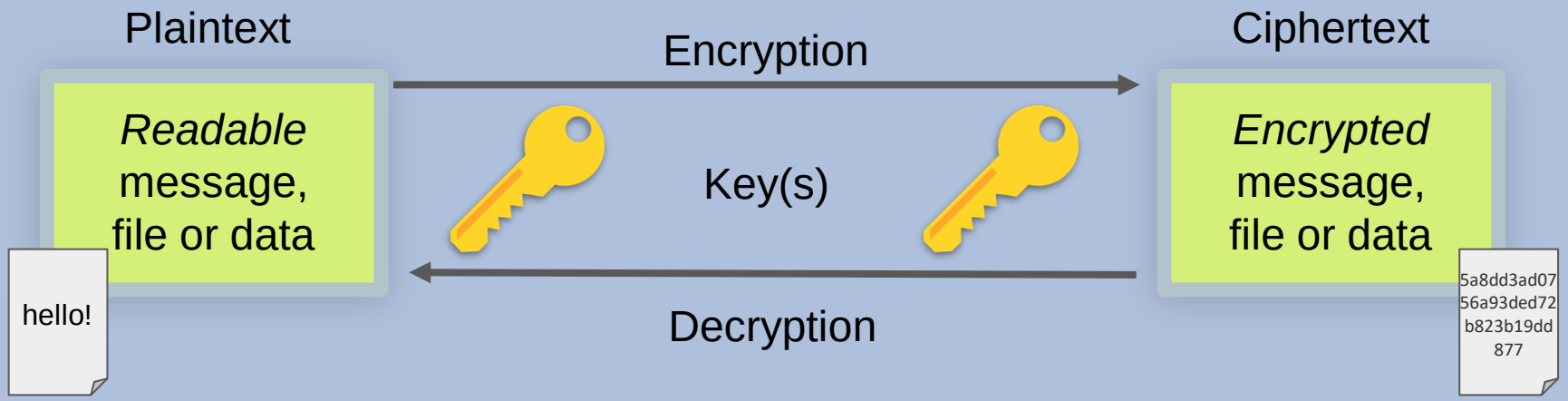


Example Activity: **Analyzing Web Traffic for Suspicious Activity**

We'll learn to process complex network traffic logs in order to find evidence of malware being sent across networks.

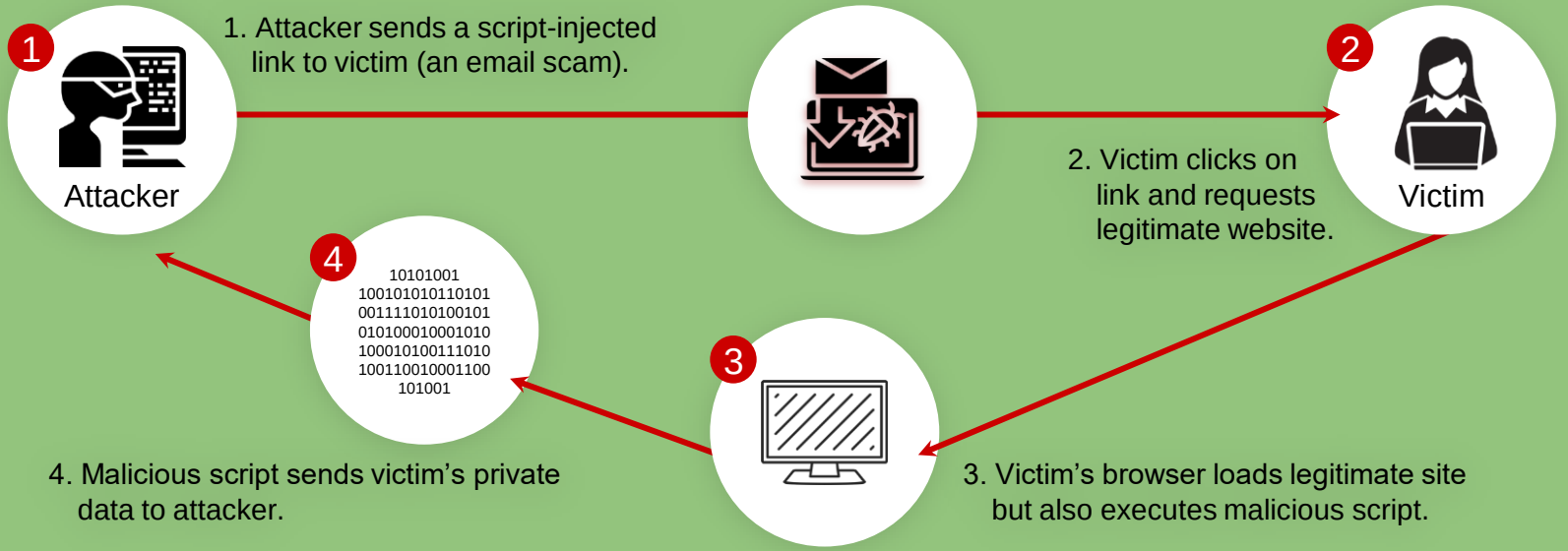
Example Activity: **Encryption / Decryption Systems**

We'll learn how modern cryptography works and how historic methods of encryption could be broken through simple means.



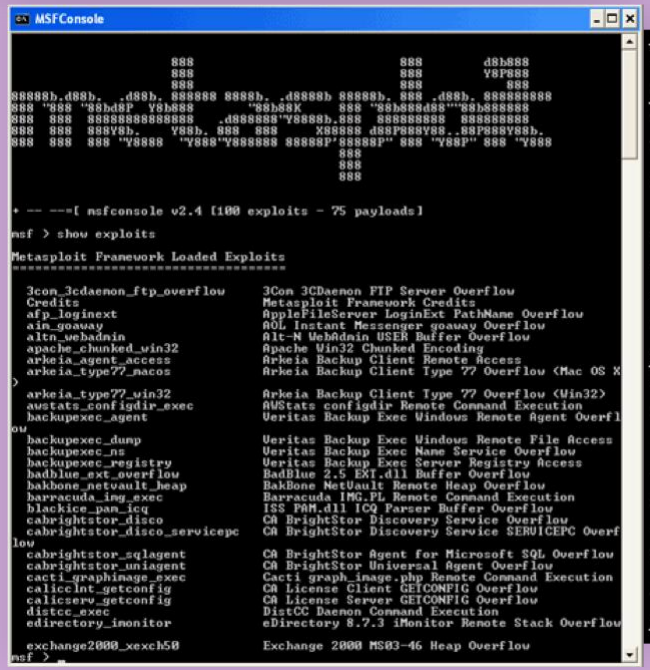
Example Activity: **Web Application Hardening**

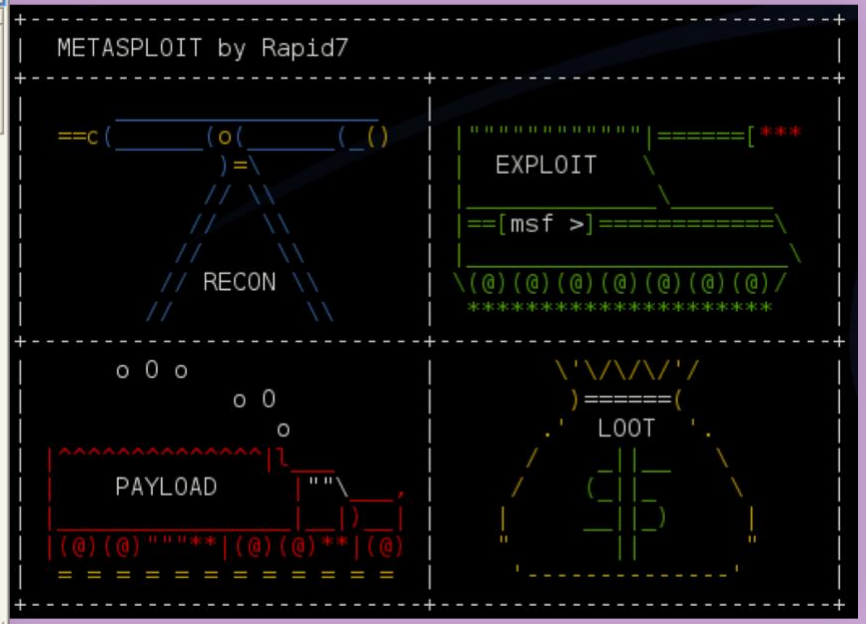
We'll learn how web applications can be defended against the most common attacks.



Example Activity: **Identify Vulnerabilities in Unpatched Systems**

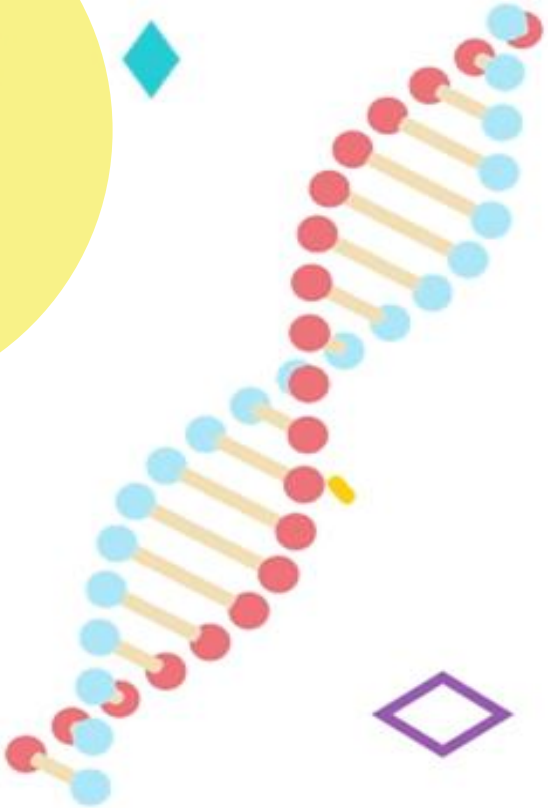
We'll learn to use tools like Kali Linux, Nmap and Metasploit to run penetration tests to identify known exploits.





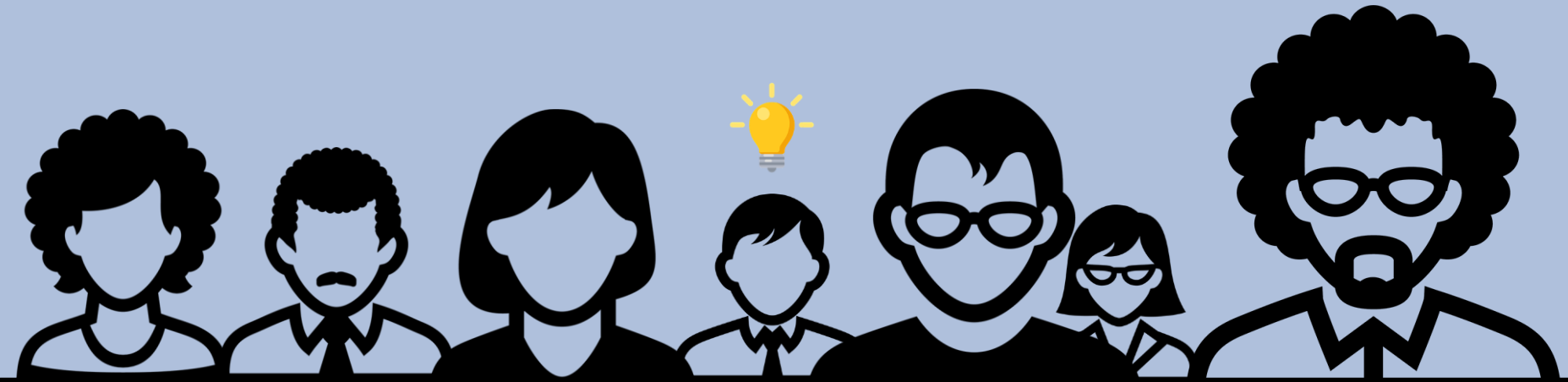
Tips

Tip: Embrace Your Curiosity



Tip: *Embrace being a beginner.*

Once you admit you “know nothing” (*or little*) about the many subject areas we cover in this course, you’ll be able to dig into these new topics and invest the time necessary to succeed.



Tip: *Find your community now.*

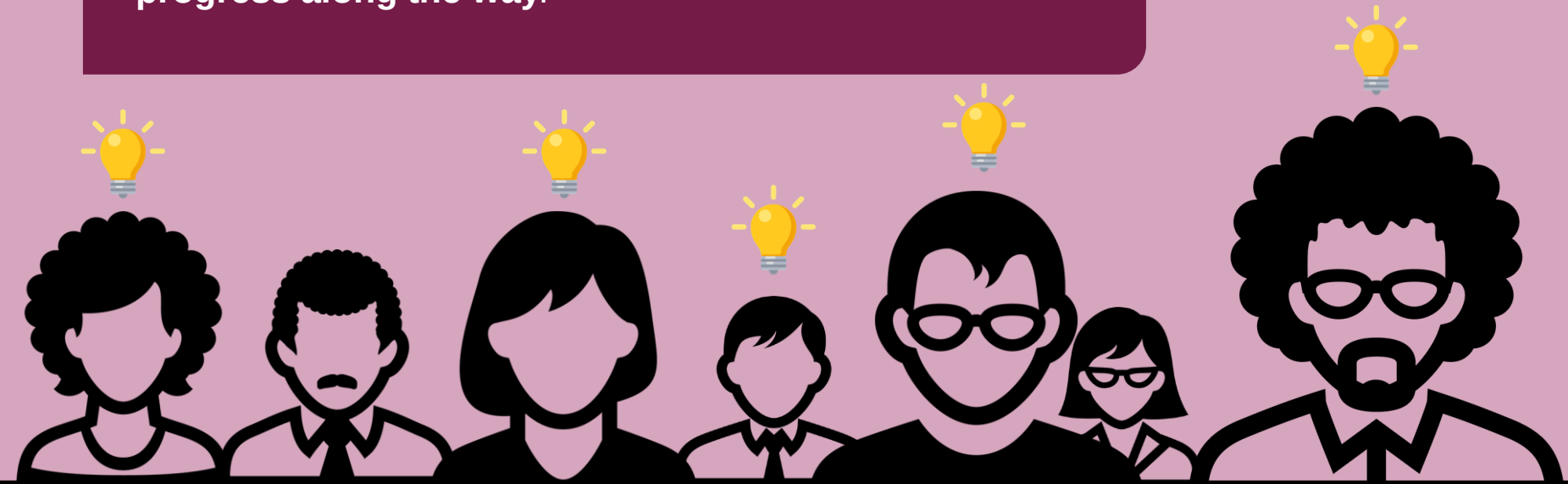
You and your classmates are in this process together. Use each other for help!

You all can bring value to the table. Don't be afraid to speak up!

Tip: *You need to put in the hours.*

There is no magic pill. This boot camp will require time and effort for you to learn and succeed.

This class will challenge you. **Make sure to celebrate your progress along the way**.




15:00
Break

Activity: Security Challenge #1: Attacking the Wall

In this security challenge, you and your group will play the role of security professionals tasked with handling a real-world situation.

Let’s review the scenario first...

Suggested Time:
15 Minutes

SECURITY CHALLENGE #1

Congratulations! You and your team have just been hired by a very successful startup that runs a Bitcoin Dating Exchange.

While their founding team is brilliant, like many startups, **they don't know the first thing about security**.

SECURITY CHALLENGE #1

They just handed you a bucket load of cash to solve their **single most pressing problem.**

Their log-in process is **totally insecure.** Hackers are **routinely logging in as users** (and administrators) and gaining access to company data and financial assets.

Activity Instructions: Security Challenge #1: Attacking the Wall

Instructions:

With your group, develop a list of 15 different ways that a malicious actor could penetrate the system and login as a user or administrator.

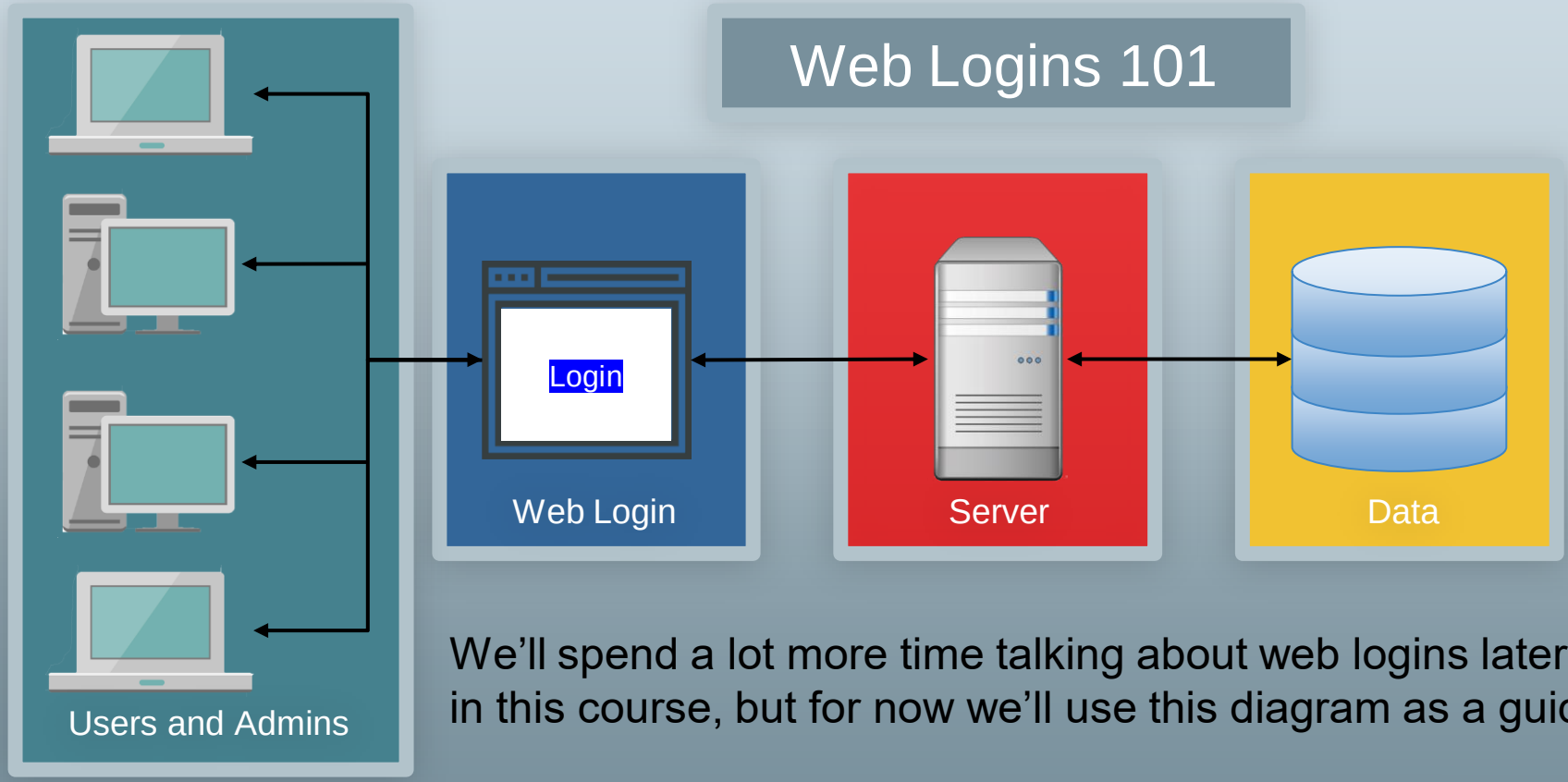
With each method, be prepared to describe the following:

- Who (or what) is the initial target?
- How would the actor implement the attack?

Be prepared to share!

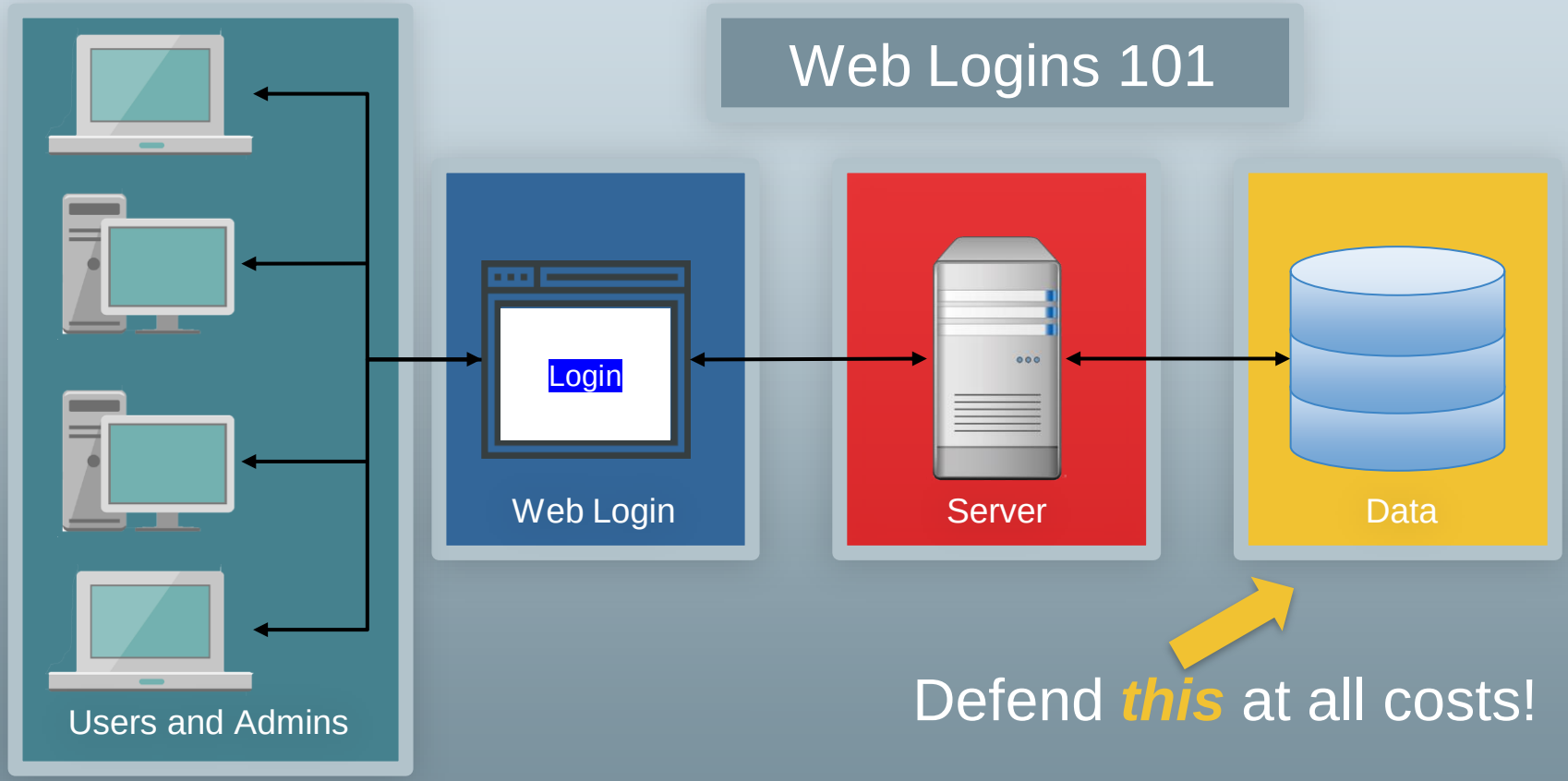
Suggested Time: 15 Minutes

Activity: Security Challenge #1: Attacking the Wall



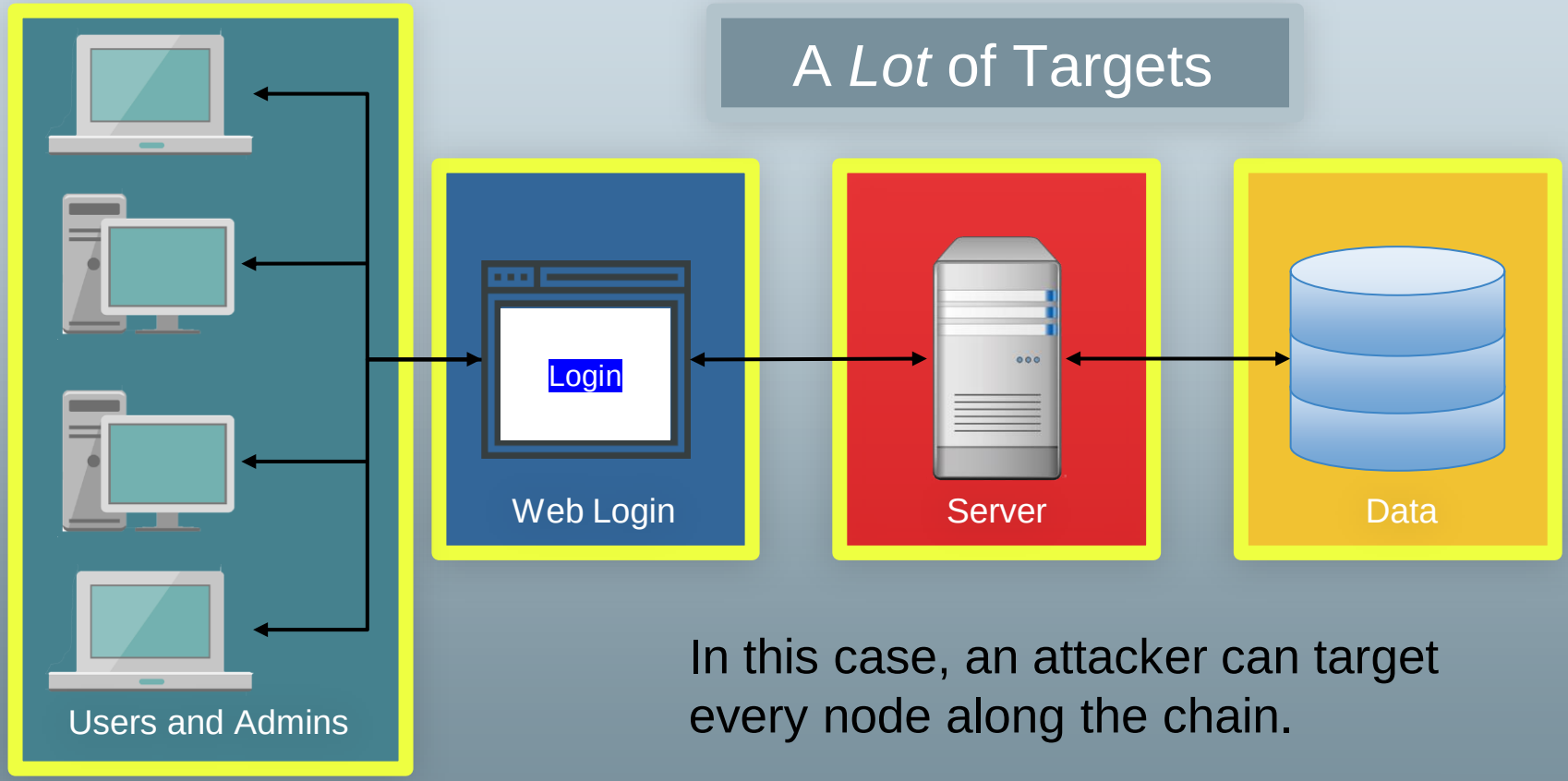
We'll spend a lot more time talking about web logins later in this course, but for now we'll use this diagram as a guide.

Activity: Security Challenge #1: Attacking the Wall



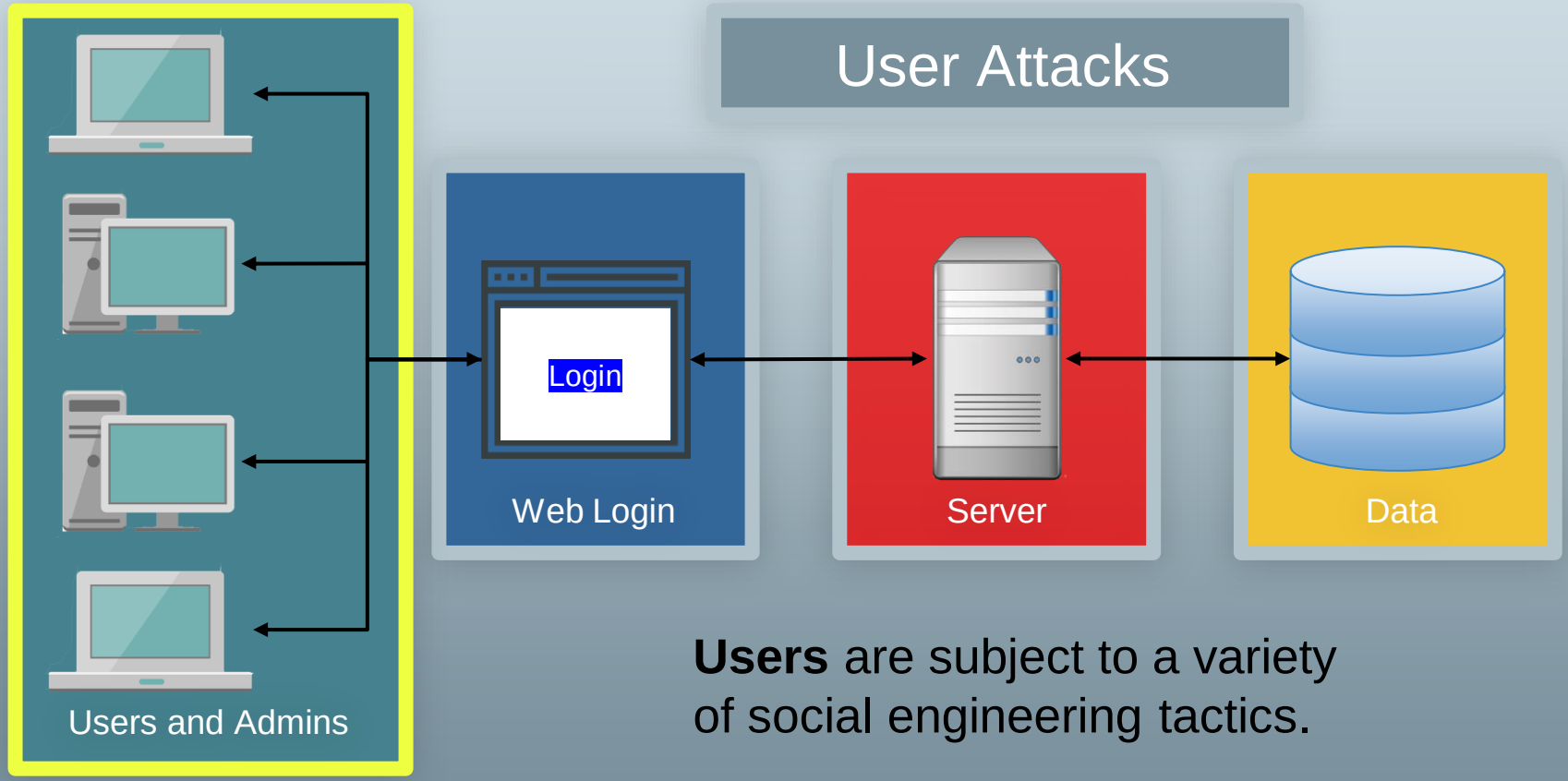
Step #1:
Assess the Target

Activity: Security Challenge #1: Attacking the Wall



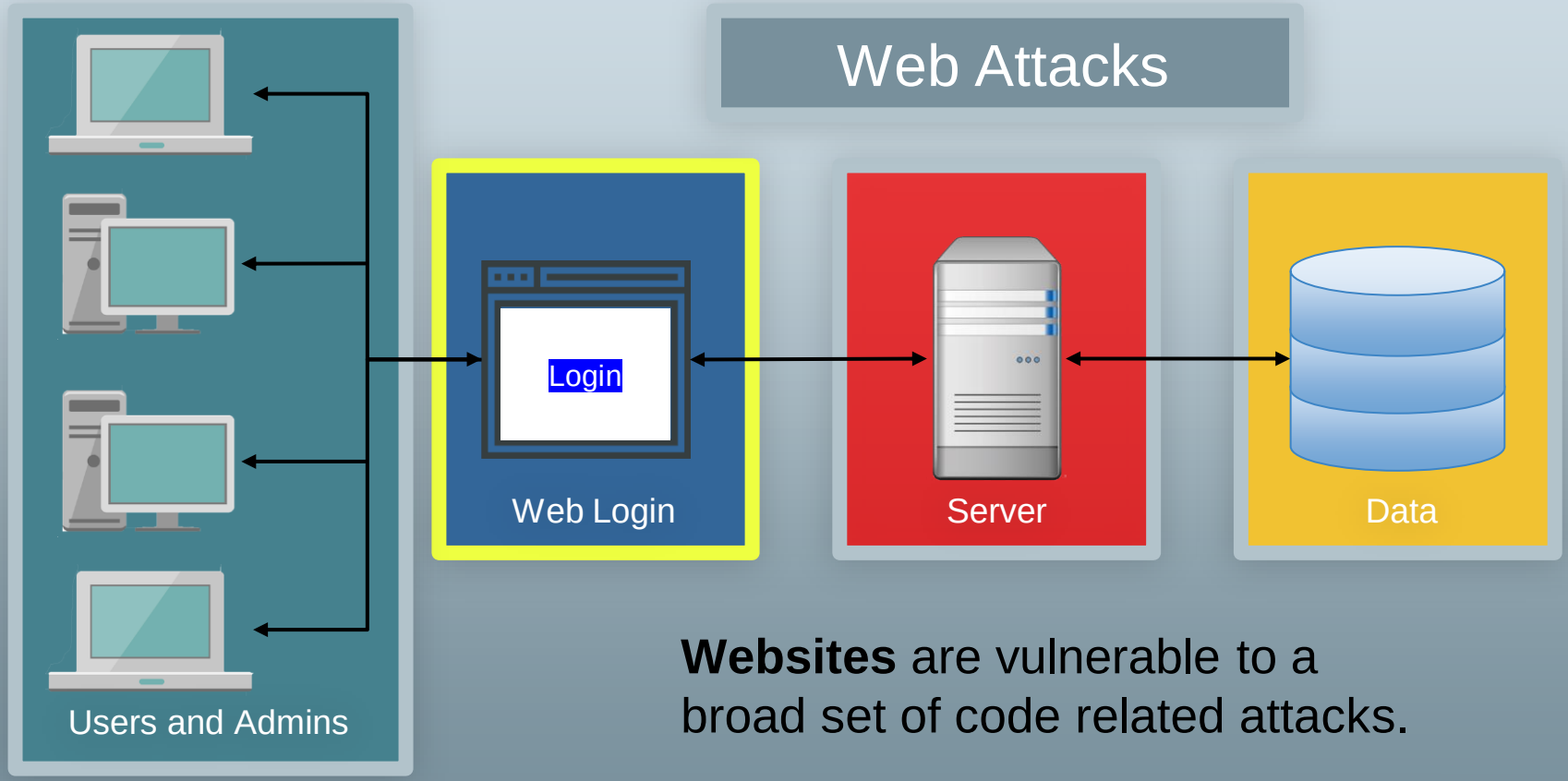
In this case, an attacker can target every node along the chain.

Activity: Security Challenge #1: Attacking the Wall



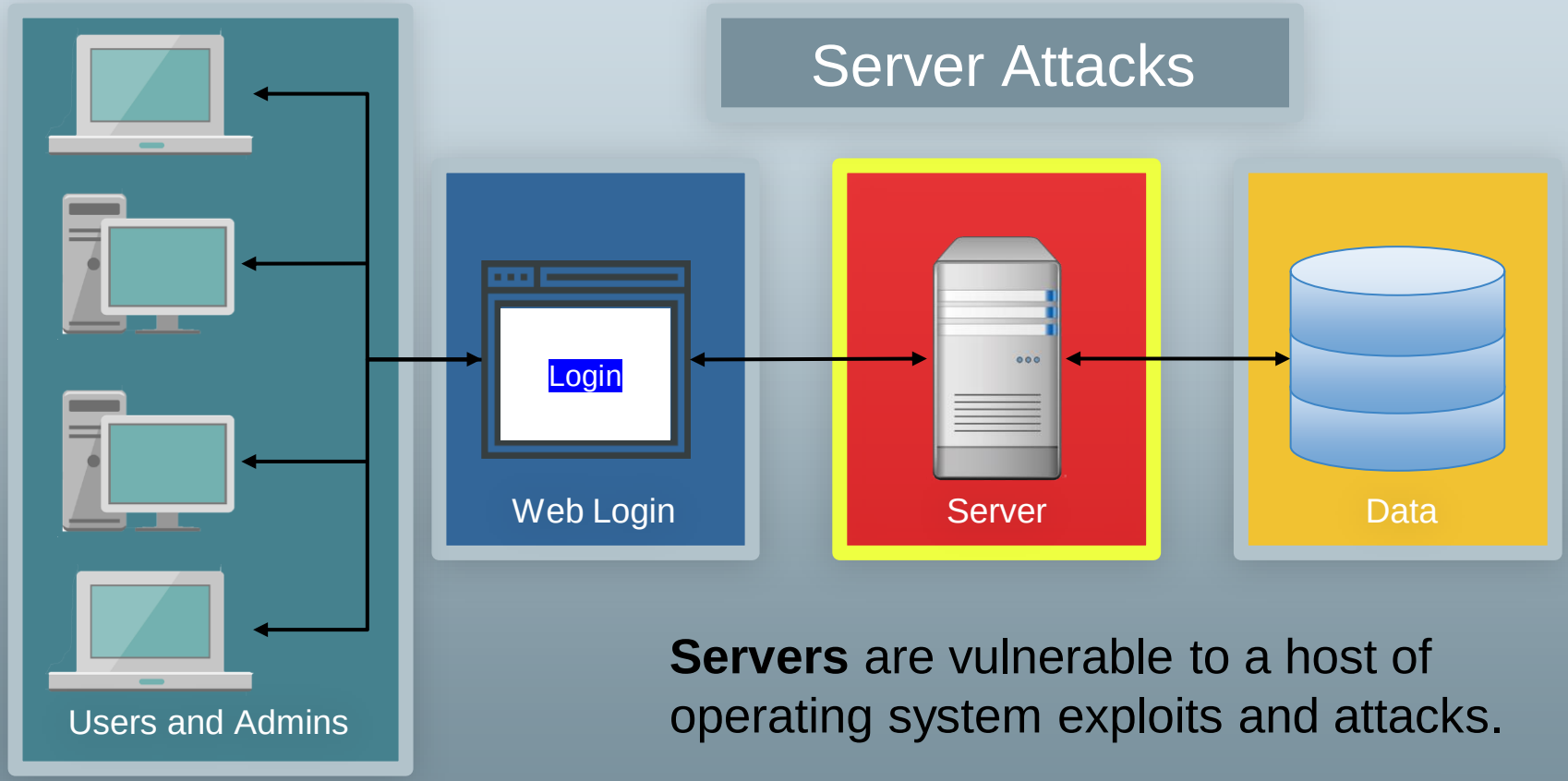
Users are subject to a variety of social engineering tactics.

Activity: Security Challenge #1: Attacking the Wall



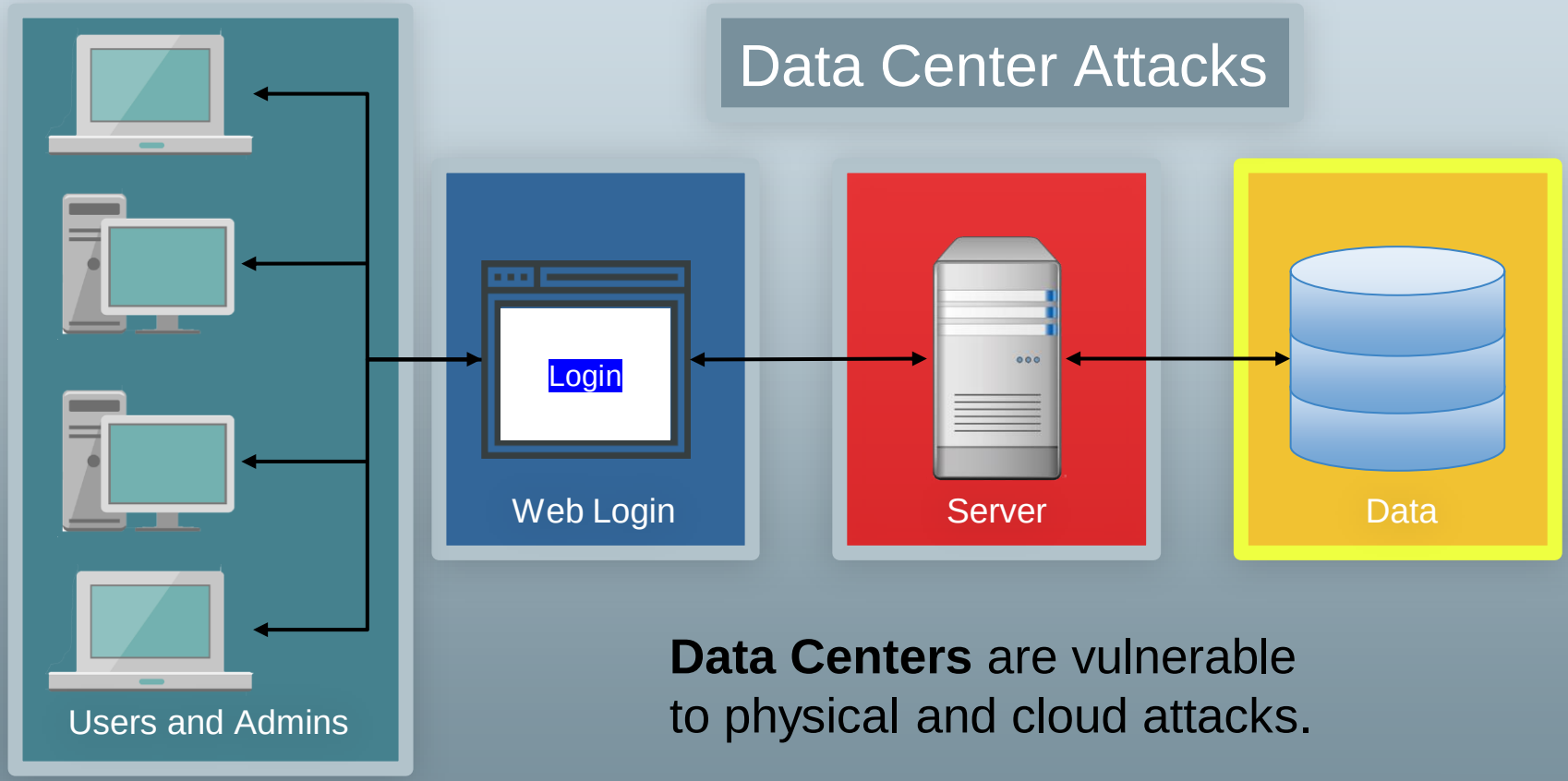
Websites are vulnerable to a broad set of code related attacks.

Activity: Security Challenge #1: Attacking the Wall



Servers are vulnerable to a host of operating system exploits and attacks.

Activity: Security Challenge #1: Attacking the Wall

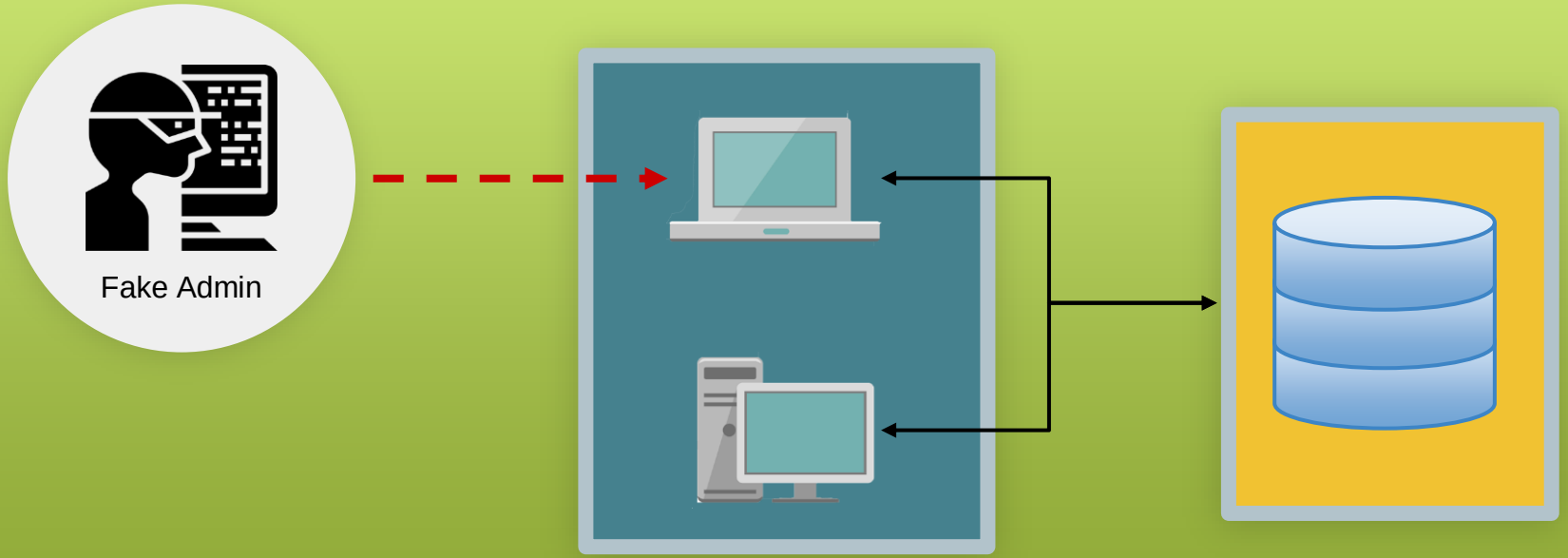


Data Centers are vulnerable to physical and cloud attacks.

Step #2:
Define Attack Strategy

Step 2: Defining Attack Strategies

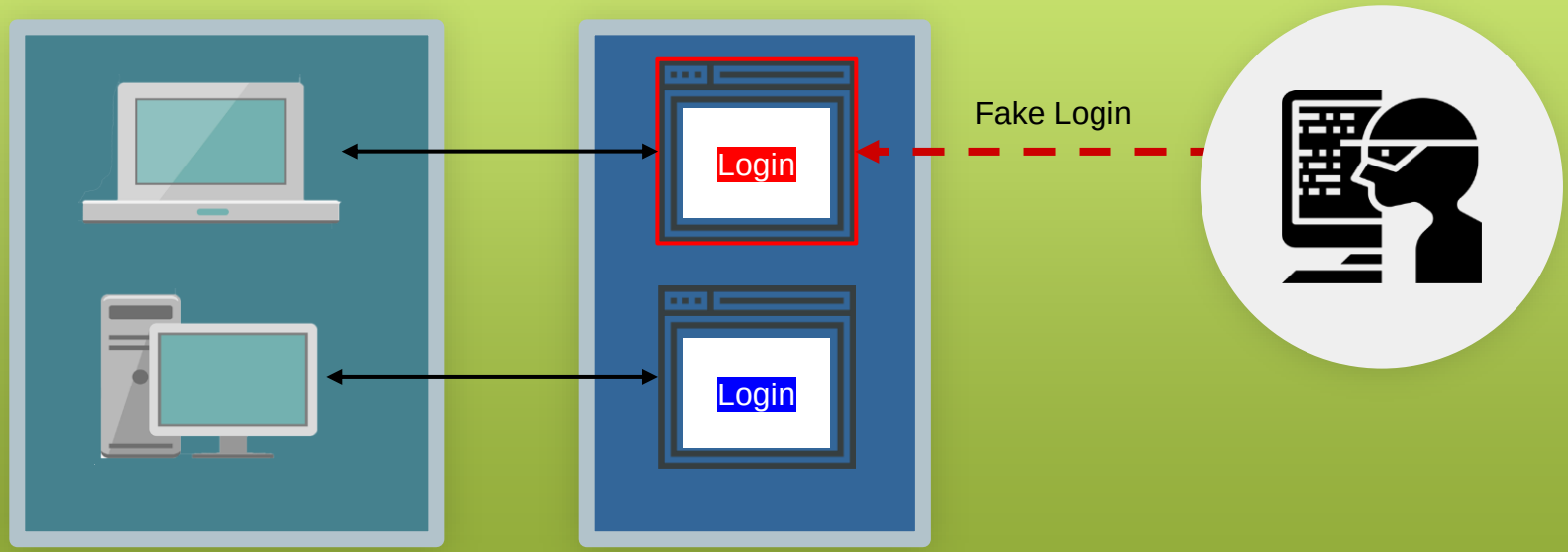
Attack Option #1: Social Engineering
A hacker can ask users for their credentials by pretending to be an administrator.



Step 2: Defining Attack Strategies

Attack Option #2: Phishing

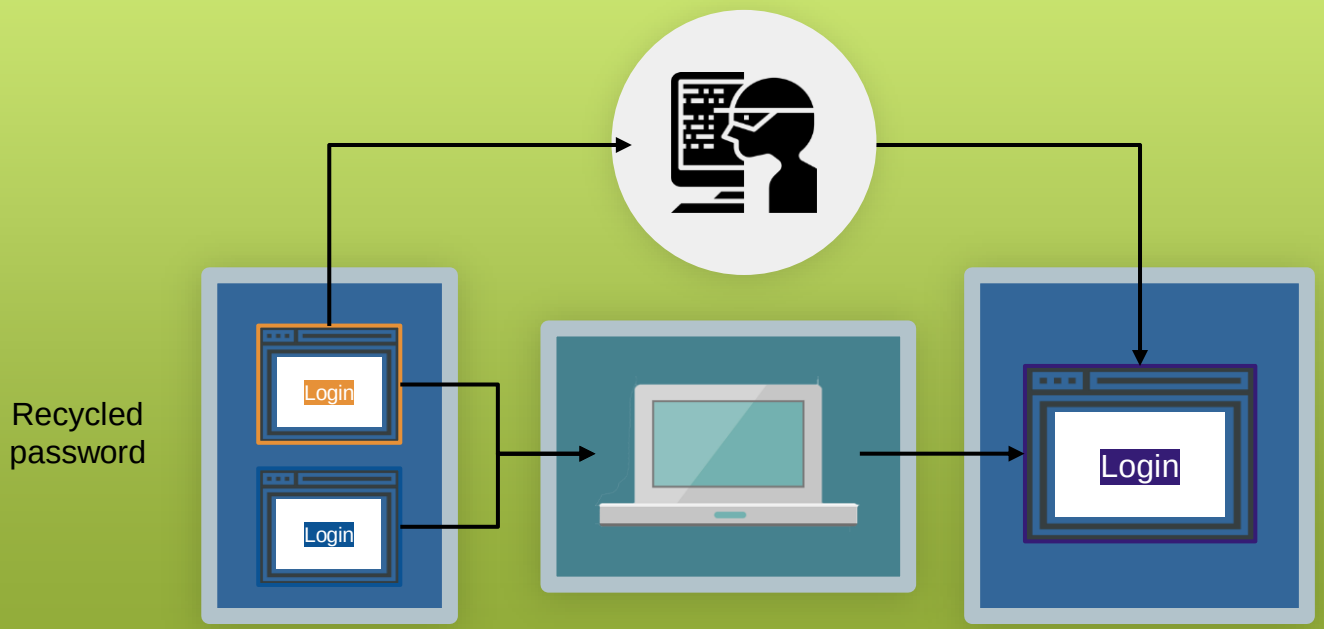
A hacker can attempt a phishing attack where users are redirected to fake login pages to capture user credentials.



Step 2: Defining Attack Strategies

Attack Option #3: Credential Reuse

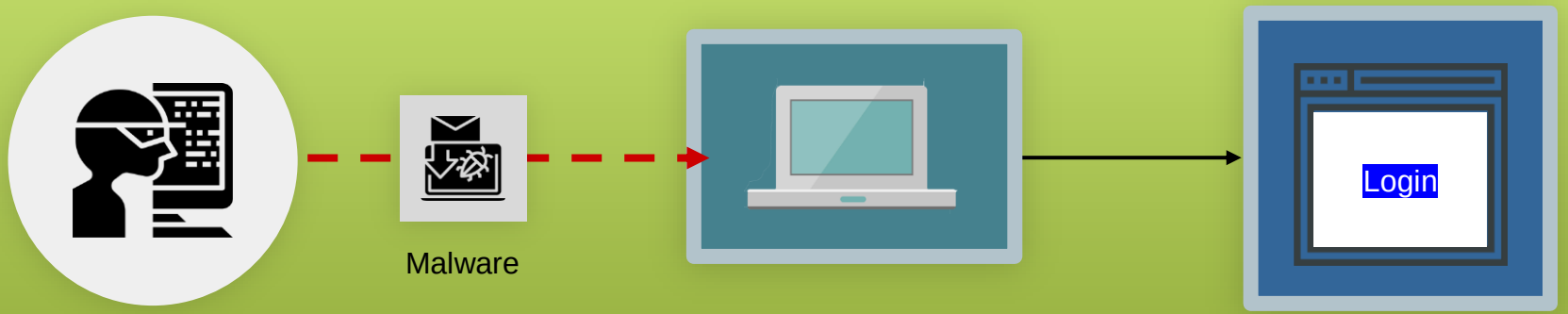
A hacker can find users' login and password information from other websites.



Step 2: Defining Attack Strategies

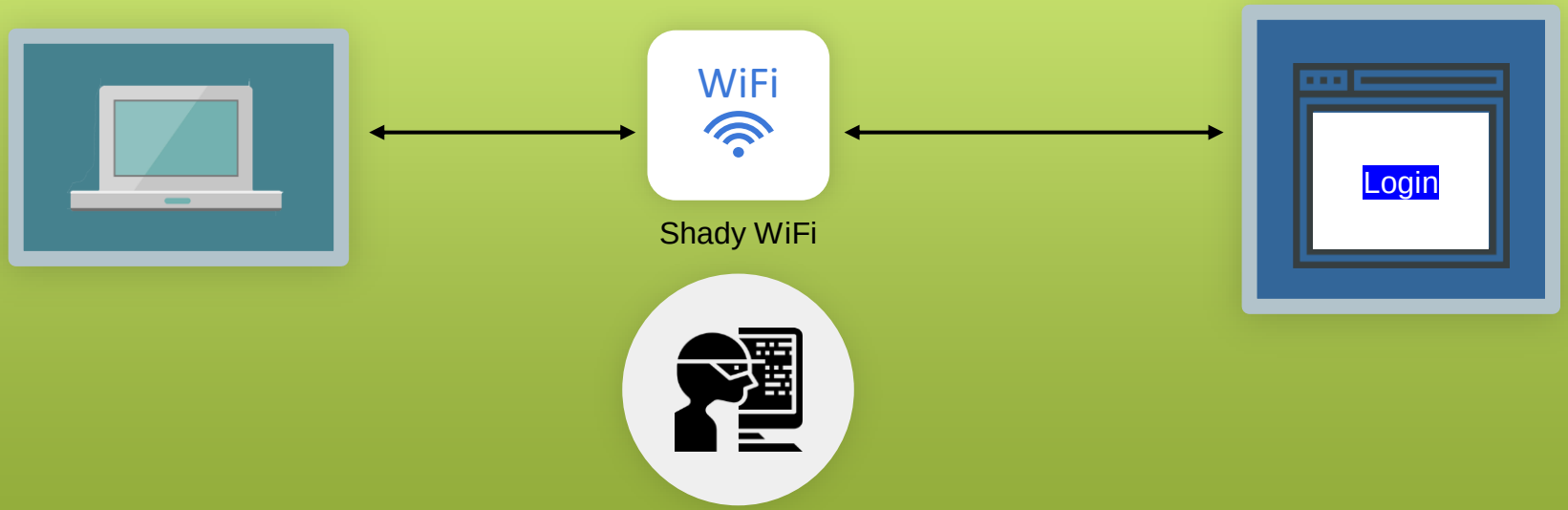
Attack Option #4: Malware

A hacker can deploy malware such as spyware or keyloggers to capture daily user activity.



Step 2: Defining Attack Strategies

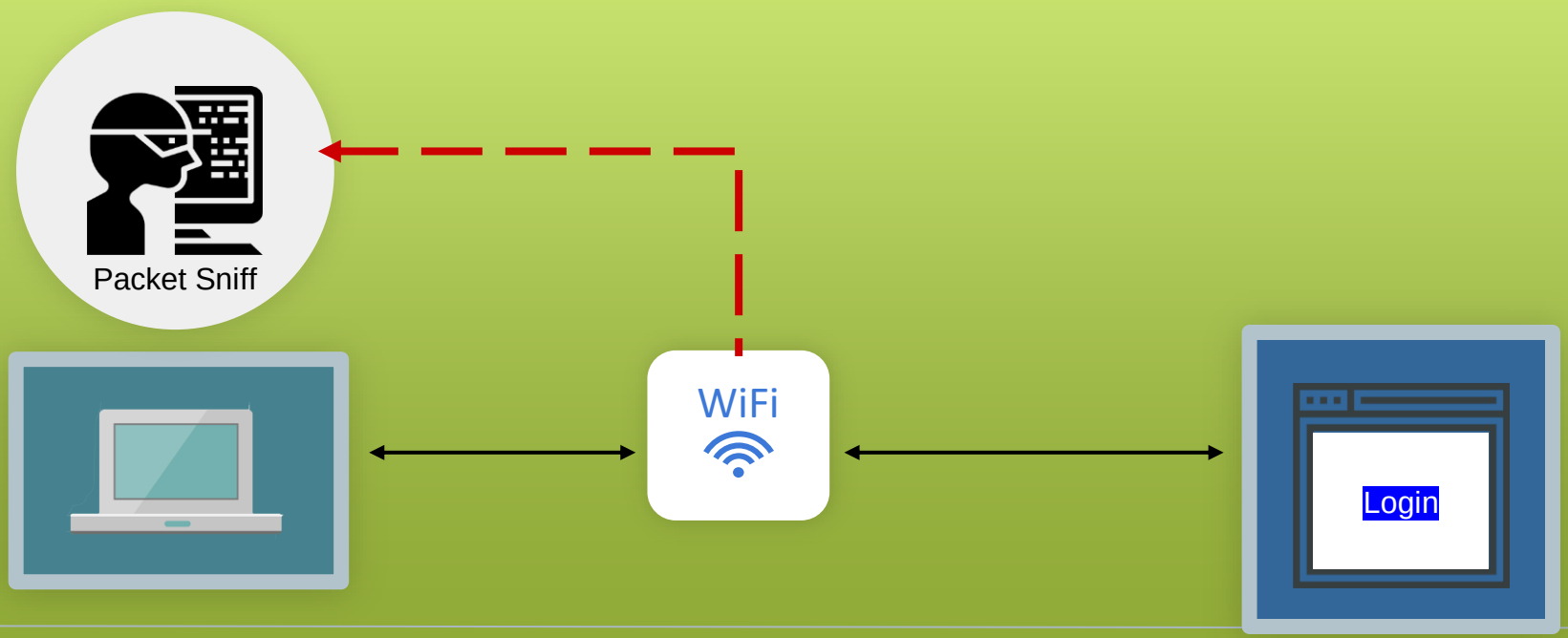
Attack Option #5: Man in the Middle Attack
A hacker can create a man in the middle attack by providing a free WiFi hotspot to capture user credentials.



Step 2: Defining Attack Strategies

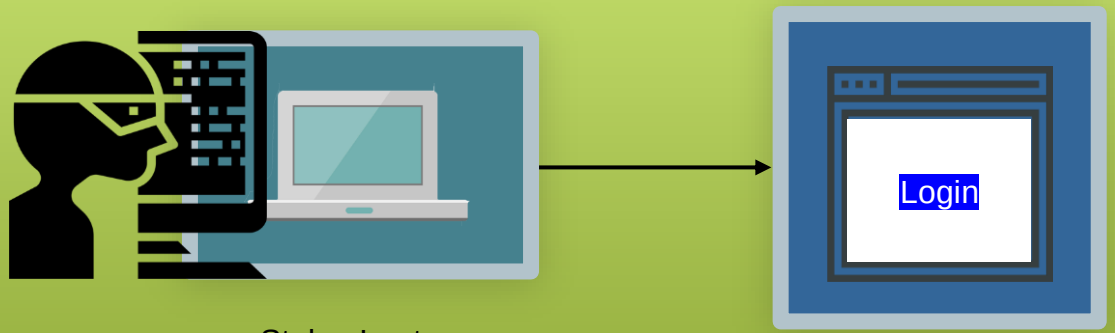
Attack Option #6: Sniff Packet

A hacker can sniff packet traffic across insecure wireless networks such as a cafe or restaurant.



Step 2: Defining Attack Strategies

Attack Option #7: Stolen Hardware
A hacker can simply **steal a computer** and use the saved credentials to login.



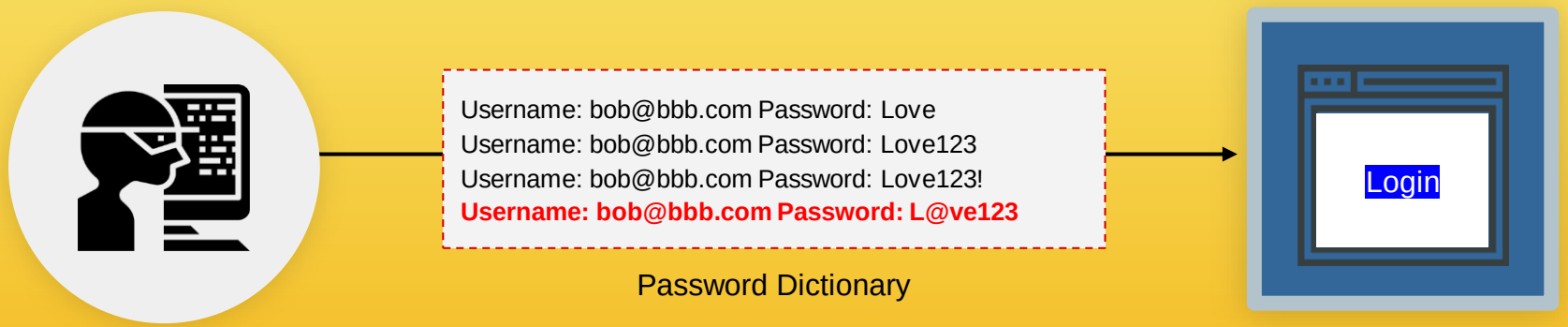
Stolen Laptop

Next: **website** attacks.

Step 2: Defining Attack Strategies

Attack Option #8: Brute Force Attack

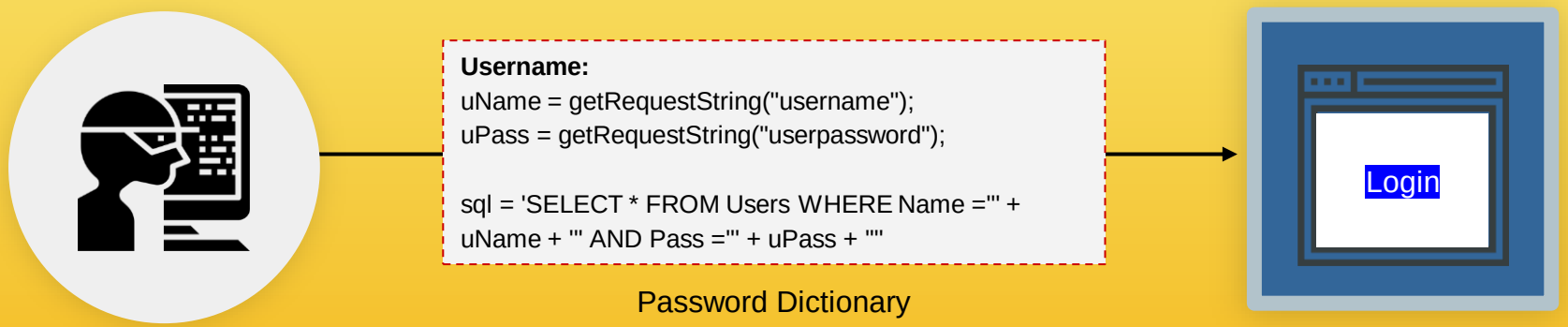
A hacker can use a **brute force attack** to continuously attempt username and password combinations.



Step 2: Defining Attack Strategies

Attack Option #9: Code-Injection

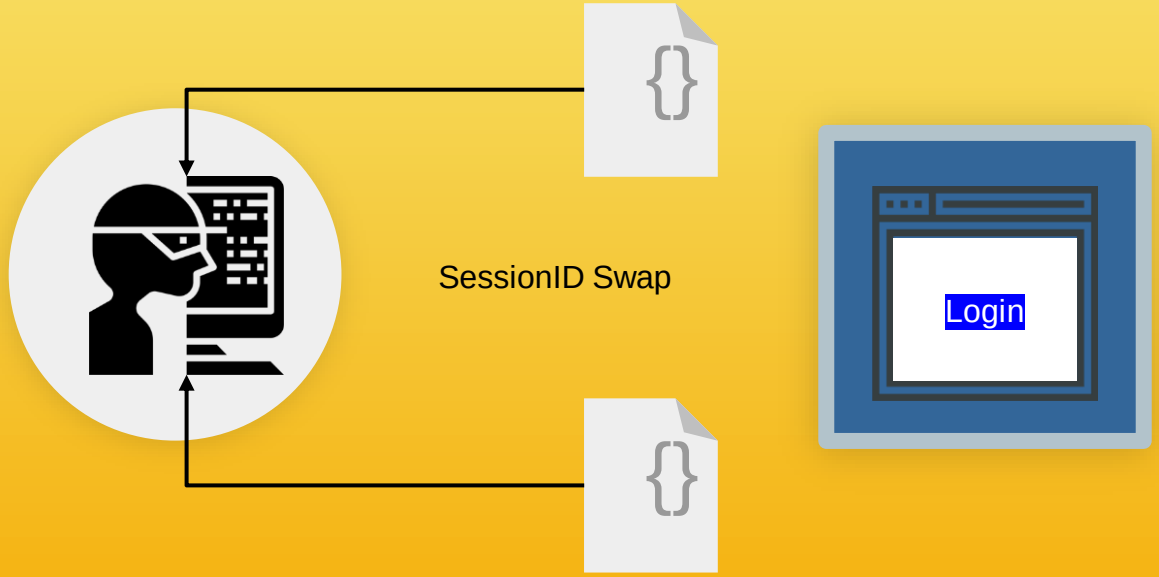
A hacker can use a **code-injection attack** in which malicious code is directly injected into the username or password fields.



Step 2: Defining Attack Strategies

Attack Option #10: Faulty Session Management

A hacker can exploit faulty session management, when developers incorrectly implement code used to maintain login and logouts.

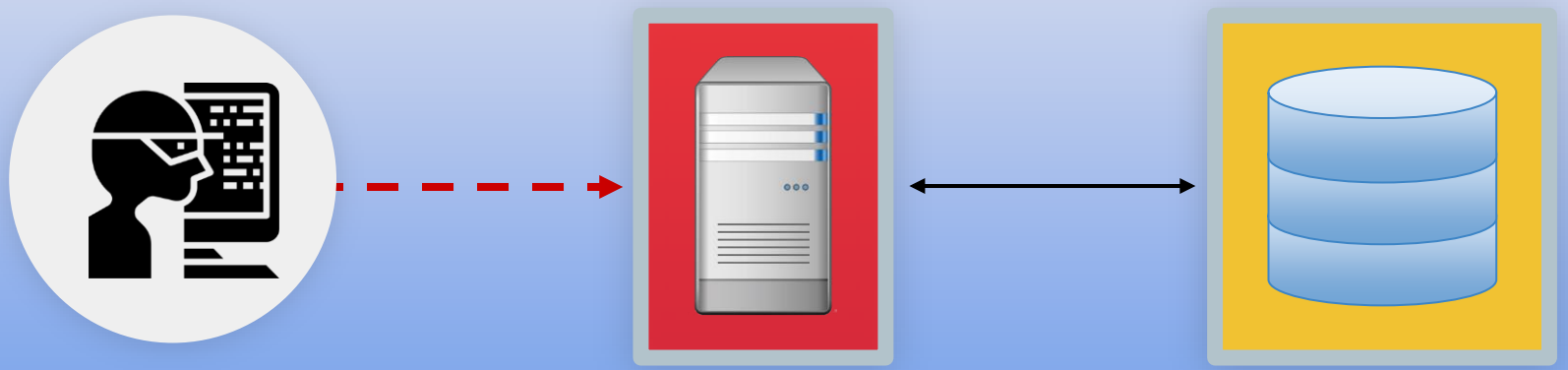


Next: **server** attacks.

Step 2: Defining Attack Strategies

Attack Option #11: OS Exploits

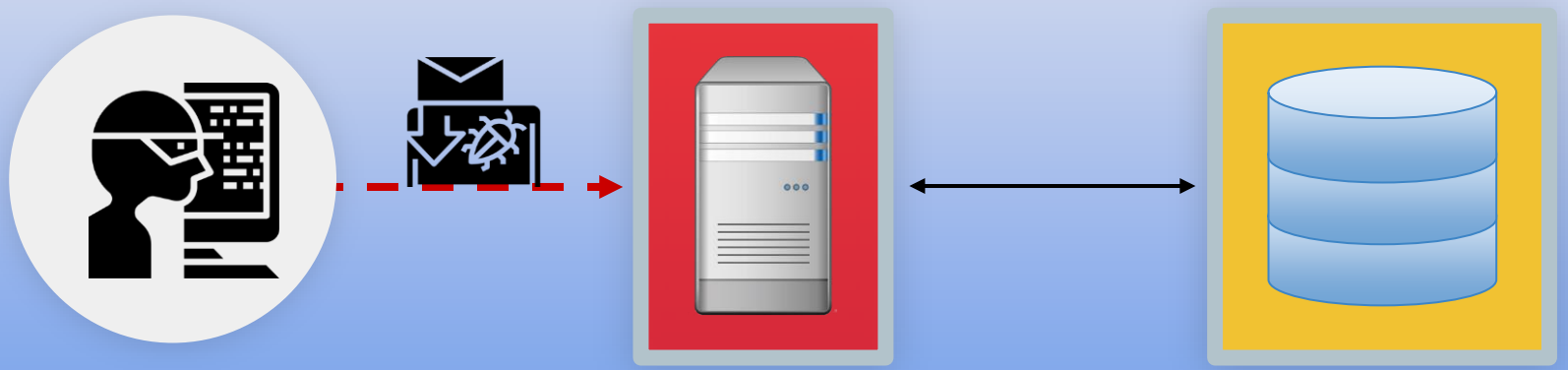
Servers, which run on operating systems like Windows and Linux, are subject to OS exploits when incorrectly patched.



Step 2: Defining Attack Strategies

Attack Option #12: Malicious Software

Malicious software can be directly loaded onto the server by USB or other means.

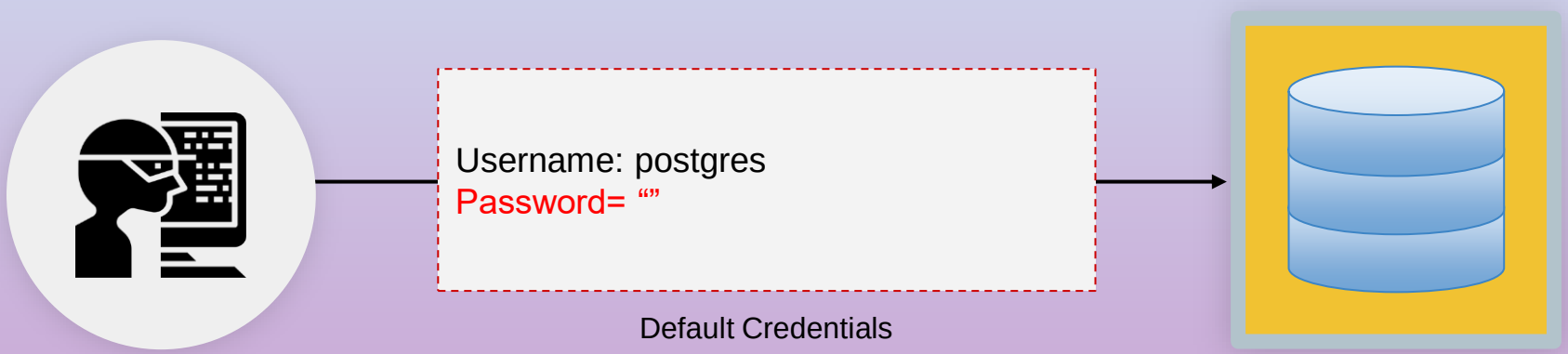


Finally: **database** attacks.

Step 2: Defining Attack Strategies

Attack Option #13: Default Credentials

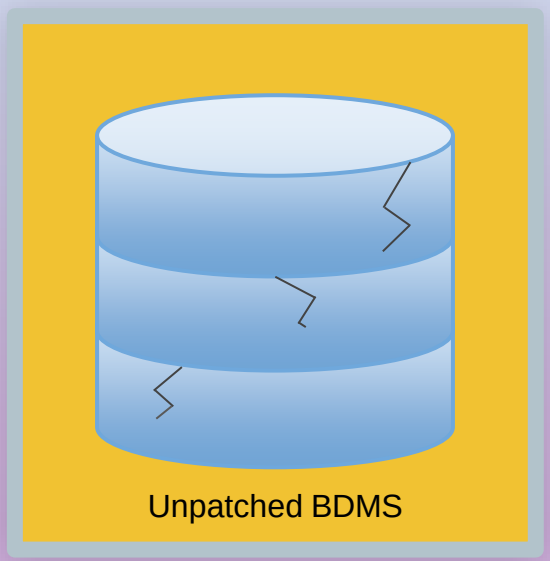
Database management systems often come with **default credentials**, which might be left unchanged.



Step 2: Defining Attack Strategies

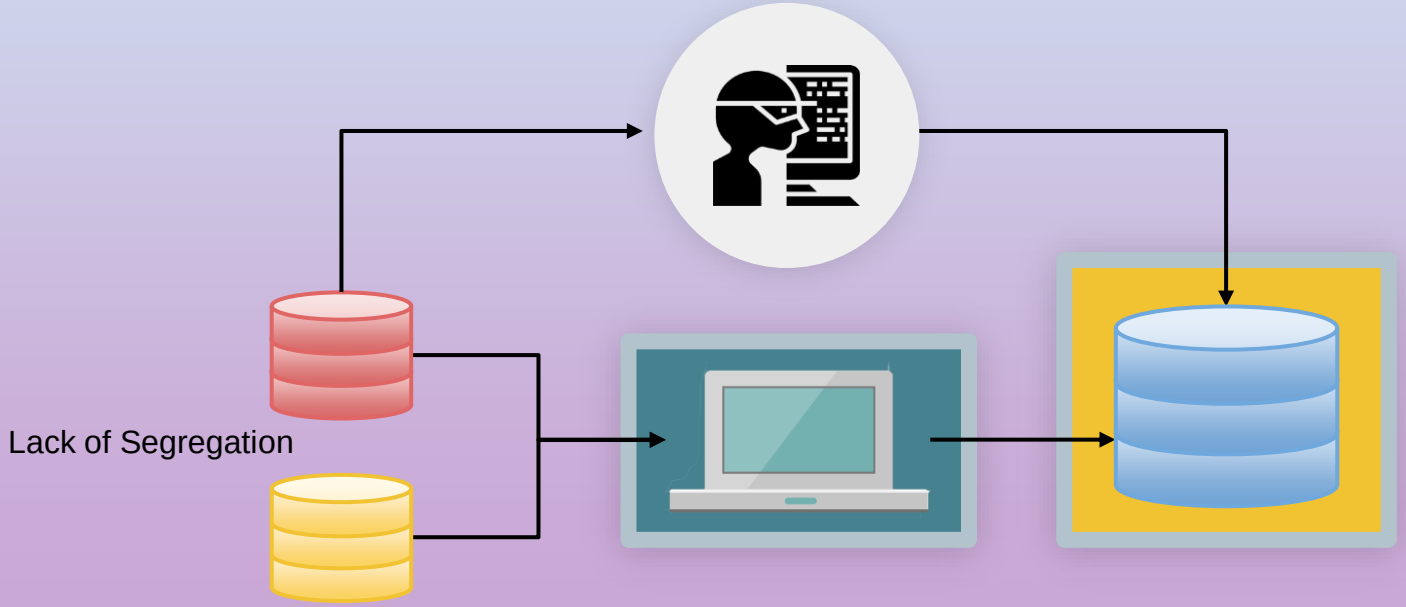
Attack Option #14: Unpatched Database

Database management systems might be unpatched against publicly known vulnerabilities.



Step 2: Defining Attack Strategies

Attack Option #15: Lack of Segregation
The database might be set up to **let a client look at another** client's data.



Security Challenge #2

Activity: Security Challenge #2: Defending the Wall

Now that we've assembled a list of potential attacks, your next task is to develop a list of at least 10 strategies to **mitigate** the website's risk of unauthorized access. *Be prepared to share!*

Suggested Time:
15 Minutes

Activity: Security Challenge #2: Defending the Wall

User Attacks	Web Attacks	Database Attacks
Social Engineering	Brute Force Attacks	Default Credentials
Phishing Attacks	Code Injection	Unpatched Database
Credential Reuse	Faulty Sessions	Lack of Segregation
Malware Attacks		
Man in the Middle	Server Attacks	
Packet Sniffing	OS Exploit	
Computer Theft	Malicious Software	

To help you get started, review this list of identified attack types.

Step Three:
Risk Mitigation Plan

Step 3: Risk Mitigation Plan

User Attacks	Web Attacks	Database Attacks
Social Engineering	Brute-Force Attacks	Default Credentials
Phishing Attacks	Code Injection	Unpatched Database
Credential Reuse	Faulty Sessions	Lack of Segregation
Malware Attacks		
Man in the Middle	Server Attacks	
Packet Sniffing	OS Exploit	
Computer Theft	Malicious Software	

Risk Mitigation begins by assessing all risks and looking for parallels.

Step 3: Risk Mitigation Plan

- User Attacks
- Social Engineering
- Phishing Attacks
- Credential Reuse
- Malware Attacks
- Man in the Middle
- Packet Sniffing
- Computer Theft

User Risk Mitigation

1. Educate all users on the danger of phishing and social engineering.
2. Use randomly generated passwords.
3. Ensure users are employing multifactor authentication (password + phone confirmation).
4. Use HTTPS and only access sensitive content over secure channels.

Step 3: Risk Mitigation Plan

Web Attacks

Brute-Force Attacks

Code Injection

Faulty Sessions

Server Attacks

OS Exploit

Malicious Software

Web and Server Risk Mitigation

1. Ensure *strong* passwords are used (i.e., alphanumeric + symbol + special characters).
2. Sanitize any input in the web application form fields and filter out.
3. Ensure users are immediately logged out when closing a browser. (No preservation of login after 30 seconds of inactivity.)
4. Ensure all servers are routinely patched against latest know vulnerabilities.
5. Incorporate antivirus and user education.

Step 3: Risk Mitigation Plan

Suggested Plan

1. Educate all users on the dangers of phishing and social engineering.
2. Require randomly generated passwords.
3. Ensure users have multi-factor authentication (password + phone confirmation).
4. Use HTTPS and only access sensitive content over secure channels.
5. Ensure *strong* passwords are used (alphanumeric + symbols).
6. Sanitize any input in the web application form fields and filter the output.
7. Ensure users are immediately logged off when closing a browser. (No preservation of login after 30 seconds of inactivity.)
8. Ensure all servers are routinely patched against latest known vulnerabilities.
9. Ensure physical access to servers is protected by multiple forms of authentication (login + biometric).
10. Ensure that all data stored in the database is encrypted and cannot be read without additional login information.
11. Provide database access on need-to-know basis.
12. Log and monitor all database access.
13. Ensure that all cloud security platforms follow best practices for security implementation.

Cybersecurity Framework

Our Cybersecurity Framework

Even in our simple exercise, we can begin to see an emerging framework for addressing cybersecurity threats.

Next Class…

We'll dive deeper into today's threat landscape and discuss modern cybersecurity tasks.

Any Questions?